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13. ABSTRACT (Maximum 200 words) The major objective of the grant was to develop biomarkers to establish exposures and risks at Air Force sites, and to investigate chemicals peculiarly associated with them. The accomplishments include a number of analytical techniques and biomarker studies that can be applied when the situations demand. Pesticide studies were undertaken only when the results were important for development of methods suitable for use at Air Force sites involving chemicals known to occur there. <div style="text-align: right; transform: rotate(-10deg); font-weight: bold;">DTIC QUALITY INSPECTED 9</div>				
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The major objective of the grant was to develop biomarkers to establish exposures and risks at Air Force sites, and to investigate chemicals peculiarly associated with them. The accomplishments include a number of analytical techniques and biomarker studies that can be applied when the situations demand. Pesticide studies were undertaken only when the results were important for development of methods suitable for use at Air Force sites involving chemicals known to occur there. A brief summary of accomplishments follows. More detailed discussions are in the annual reports.

Biomarkers:***Cholinesterases***

Organophosphate pesticides and chemical warfare agents are often monitored by cholinesterase measurements. Major improvements have been made in the clinical and field methods used to determine blood enzymes in man, laboratory animals and wildlife.

Neuropathy Target Esterase

Air Force brake fluids once contained the ortho isomer of tri-cresyl phosphate. A substance associated with outbreaks of a long term neuropathy. Purification methods were studied for neuropathy target esterase (an enzyme associated with the organophosphate induced delayed neuropathy) and we made a good beginning on methodology to establish its localization in the nervous system.

Fecal Testosterone in Mice

Wild animals are important sentinels at Air Force sites and other ecosystems. A method to determine the testosterone level in feces of mice was developed and subjected to a field test at Mare Island. The method will permit non-invasive determination of testosterone levels in wild animals allowing us to establish their reproductive state. Such studies may provide early warning signs of environmental problems, since reproduction is a sensitive feature of the physiology of animals.

Cell and Organ Cultures

Alternatives to animal testing were studied using metals and organophosphates, TCDD-like molecules and nerve, muscle and liver cultures and liver from bird embryos. Highly differentiated surface cultures and brain cell reagggregates were developed and studied. Induction of EROD activity could be demonstrated in embryos and liver cells from wild birds and interactions of cadmium and organophosphates were demonstrated in vitro with muscle and nerve cells.

Analytical

The analytical part of the project focused on improving methods of extraction of environmental contaminants important to the Air Force using techniques such as super critical extractions. Soils were analyzed for important contaminants from Air Force sites.

Conclusion

The project ended with the scientists poised to carry out combined laboratory and field studies with biomarker and analytical techniques at selected Air Force sites such as Beale Air Force base.

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